CBCS SCHEME

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21EC732

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Digital Image Processing

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. With neat diagram explain Single image sensor, how it can be used in Sensor Strip and Sensor Array. **(08 Marks)**

b. Explain basic concept of Sampling and Quantization with reference to Digital Image. **(07 Marks)**

c. Calculate the photon energy for visible light for given wavelength range 400 nm to 750 nm. [Plank's constant, $h = 6.63\times10^{-34}$ Js, $C = 3\times10^{8}$ m/s] **(05 Marks)**

OR

2 a. Explain the Brightness Adaption and Discrimination. **(07 Marks)**

b. Explain the Neighbour pixel basic relationship in Digital Images with adjacency connectivity, Regions and Boundaries. **(08 Marks)**

c. Given two pixels P and Q with coordinate positions (–2, –2) and (3, 4) respectively, calculate the distance measure D_e , D_4 , D_8 . **(05 Marks)**

Module-2

3 a. Define 2-D orthogonal and unitary transform. **(06 Marks)**

b. For given orthogonal matrix A and an image u obtain unitary transform.

Given $A = \frac{1}{\sqrt{2}}\begin{pmatrix}1 & 1\\ 1 & -1\end{pmatrix}$ $\quad u = \begin{pmatrix}1 & 2\\ 3 & 4\end{pmatrix}$ **(08 Marks)**

c. Define the properties of unitary transform. **(06 Marks)**

OR

4 a. Define 2-D DFT and its properties. **(06 Marks)**

b. Define cosine transform and its properties. **(06 Marks)**

c. Calculate Haar transform for N = 4

Given Haar function $H_a(z) = \frac{1}{\sqrt{N}}\begin{cases} +2^{p/2}, & \frac{q-1}{2^p} \le z < \frac{q-0.5}{2^p} \\ -2^{p/2}, & \frac{q-0.5}{2^p} \le z < \frac{q}{2^p} \\ 0, & \text{else} \end{cases}$

$n = \log_2 N$
$p = 0$ to $n-1$
q range between $1 \le q \le 2^p$
$k = 2^p + q - 1$
$z = 0,\ 1/4,\ 2/4,\ 3/4$ **(08 Marks)**

Module-3

5 a. With necessary graph and equation explain
i) Image Negative
ii) Power law transformation
iii) Intensity level slicing **(06 Marks)**

b. Compute Histogram equalization for given data:

Table 5(b)

r_k	0	1	2	3	4	5	6	7
n_k	790	1023	850	656	329	245	122	81

for 3 bit image (L = 8) of size 64×64 pixels (MN = 4096) with intensity distribution shown in Table 5(b). Intensity level are integer in range [0, L-1] = [0, 7] **(08 Marks)**

c. With an example for 2-bit image of size 5×5 define the sample mean, sample variance with equation. **(06 Marks)**

OR

6 a. Explain with example fundamentals of Spatial Filtering for spatial correlation and convolution for 1-D and 2-D filter. **(08 Marks)**

b. Using 1st order derivative Image Sharpening (the Gradient) define:
i) Robert's cross gradient operation
ii) Sobel's operators (for 3×3 region) **(06 Marks)**

c. Define smoothing spatial filters with brief note:
i) Linear Filters
ii) Order Statistic Filter **(06 Marks)**

Module-4

7 a. With neat block diagram of Homomorphic system, derive Homomorphic filtering approach for Image Enhancement. **(08 Marks)**

b. Define sharpening of images in frequency domain using
i) Ideal High Pass Filter
ii) Butterworth High Pass Filter
iii) Gaussian High Pass Filter **(06 Marks)**

c. Give Frequency domain filtering necessary steps followed. **(06 Marks)**

OR

8 a. Define pseudo color image processing with intensity slicing and intensity to color transformation. **(06 Marks)**

b. Based on Hardware oriented models classify different color model given color conversion for RGB to HIS and vice versa with relevant equation. **(08 Marks)**

c. With color fundamentals for primary and secondary colors. **(06 Marks)**

Module-5

9 a. Write brief note on restoration in presence of only noise using
i) Mean filter ii) Order statistic filter iii) Adaptive filter **(08 Marks)**

b. Discuss some of the important noise probability density functions. **(06 Marks)**

c. With help of block diagram give details of Degradation / Restoration process. **(06 Marks)**

OR

10 a. In digital images discuss about Inverse Filtering. **(06 Marks)**

b. Explain minimum mean square error (Wiener Filter) in Digital Image Processing. **(08 Marks)**

c. Discuss periodic noise reduction by frequency domain filtering. **(06 Marks)**

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